Bridging the Digital Divide – the E-Bario and E-Bedian Telecommunication Framework

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Abstract. This paper describes a rural ICT (Information and Communication Technology) project in the most remote areas of Sarawak, the Bario and Long Bedian. In the absent of both regular power supply and basic telecommunication infrastructure, the e-Bario and the e-Bedian projects overcome the challenges in providing the community and the schools with Internet connectivity. The telecommunication infrastructure implemented in the project is also discussed which include the use of VSAT (Very Small Aperture Terminal), call routing and wireless technology.

Keywords. VSAT (Very small aperture terminal), Rural ICT, e-Bario, e-Bedian.

1. Introduction

The importance of bringing information and communication technology (ICT) services to rural areas is increasingly recognized as a means to enhance economic development. This is shown from efforts by the government to implement ICT in all remote areas and schools in Malaysia. To implement ICT in remote areas successfully, many issues need to be resolved especially the diverse engineering requirements. Several technologies must be employed according to local conditions and requirements. Capital cost of equipment is another major issue as operation and maintenance in order to achieve sustainability of the project.

This paper presents two telecommunication models of rural ICT implemented in remote areas of Sarawak, the e-Bario and e-Bedian project.

2. Background of Bario and Long Bedian

Bario, the home of the Kelabits is slightly 1000m above sea level in the interior of Sarawak. It is about 400km to the South East of Miri and covers an area of about 5km radius of beautiful mountains, valleys and padi fields. The journey from Miri to Bario takes about an hour's flight using a Twin Otter plane. There was only a daily flight from Miri to Bario, bu since October 2003, MAS has provided a twice-daily flight. By land, the journey may take 4-5 days to reach Bario from Miri.

There are about 1000 Kelabits living within the 5 km radius of the center – the small town with shophouses. The Kelabits are mostly farmers planting both wet and dry padi and are well known for their fragrant Bario rice.

Long Bedian is another remote area situated about 500km from Miri. It is the home of the Kayans, another indigenous group in Sarawak. Long Bedian can be accessed either by boat (on the Baram river) or by land (through logging tracks). By boat, one has to take a 25 minutes flight from Miri to Marudi and from Marudi to Long Lama, a journey of about 3 hours by longboat before proceeding another 2-hour journey by four wheel-drive through logging tracks. By land, the journey to Long Bedian from Miri takes about 5 hours through logging tracks. The Kayans in Long Bedian are mostly farmers while some are involved in operating small shops. Others work in logging camps driving timber trucks and cranes.

3. Telecommunications Infrastructure in Bario and Long Bedian.

Telecommunication infrastructure in Bario and Long Bedian were very "basic" before the implementation of the ICT project by UNIMAS. The community depended solely on the unreliable radio call to communicate with the outside world. Radio calls were limited to certain hours only and conversations were made public as anybody with the right equipment can listen in on the conversation.

Public utilities such as 24-hour electricity supply and treated water are not available in both these places and the community relies on generator set or solar power to generate electricity for their basic needs. In Bario, the generators are provided by the government to supply electricity to school, clinics and other public facilities for limited hours due to the expensive cost of fuel. On the other hand, in Long Bedian, the electricity supply comes from the village generators and the village folks pay for the cost of fuel (cost of fuel in Long Bedian is lower given its accessibility to Miri by road). Because of the insufficient power for telecommunications equipment, Radio Channel Services (RCS), a half duplex communication system was then the only available means of communicating to the outside world. Mail takes days or even

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weeks to reach these remote places and up-to-date newspaper is a luxury.

The lack of communication systems has been the major drawbacks to the development in both these places. The school children were already disadvantaged both economically and socially, and have had little or no exposure to the outside world. The community folks occasionally received news from families and friends through mail or from any relatives returning home for a holiday.

4. Project Planning and Implementation

To implement ICT projects in the rural areas such as Bario and Long Bedian successfully, it is important to understand the rural environment and its characteristics and to address the problems objectively. Our initial feasibility studies had shown that both these areas have common attributes:

- Limited accessibility with uneven, rough and rugged terrain.
- Inadequate and unreliable power supply, depending solely on solar power and generators.
- Low populations and limited income.
- Far from urban areas (such as Miri and Marudi) and very difficult terrain to travel.
- Lack of trained personnel.
- There is a great need to communicate with the outside world.
- Awareness and readiness by the community in general to accept new technology.

Taking the points into consideration, it was decided that both data and voice communication could be implemented in Bario and Long Bedian. This will provide the school children and the community with the basic tools to communicate with the outside world. For voice communication, telephone booths were installed at several strategic locations and, computers on a local area network (LAN) were set up at the Telecentre and school.

For the trunk line linking Bario and Long Bedian to the Miri exchange office several options were considered. These include:

- Laying cables from Miri to Bario/Long Bedian
- Microwave Links
- Inmersat
- VSAT (Very Small Aperture Terminal)

Cables and microwave links are not possible to implement because of the distance between Miri to Bario/Long Bedian. Vast primary forests with no accessibility by roads between these places make it even more difficult. The solution is thus to use either Inmarsat or VSAT. Inmarsat is a portable satellite telephone that can provide services like PSTN and dial-up Internet at 2.4 kbps. It is easy and simple to install and the terminal is portable. The drawback is its low bandwidth, which insufficient for several computers to have Internet access simultaneously.

The best option is the VSAT. VSAT is a Very Small Aperture Terminal and uses satellite to link signals from remote places to central exchanges. The new generation VSAT is available in the following models:

- TM Skystar Advantage (Data and IP) – Interactive data
- TM Dialaway and Ethernet LAN
- TM Faraway (Telephony and Data/IP) – Telephony and Data.

(Rahim, Hashim and Tahir, 2001).

All the above models can provide connectivity ranging from 153.6 kbps up to 2 mbps depending on the type of services and applications, thus these models are very suitable for high speed broadband applications (Rahim, Hashim and Tahir, 2001). In addition, this new generation VSAT can be solar powered, which is best suited to areas like Bario and Long Bedian. With VSAT connection four independent parabolic dishes were installed by Telekom Malaysia in Bario; one each at the airport (voice), clinic, telecentre and school (Rahim, Hashim and Tahir, 2001). This is shown in Figure 1. At the telecentre one local area network with bus configuration was installed. This configuration can accommodate about 10 PCs with the available bandwidth and provides enough speed to access the Internet. Each PC is connected to the Internet through a switching hub.
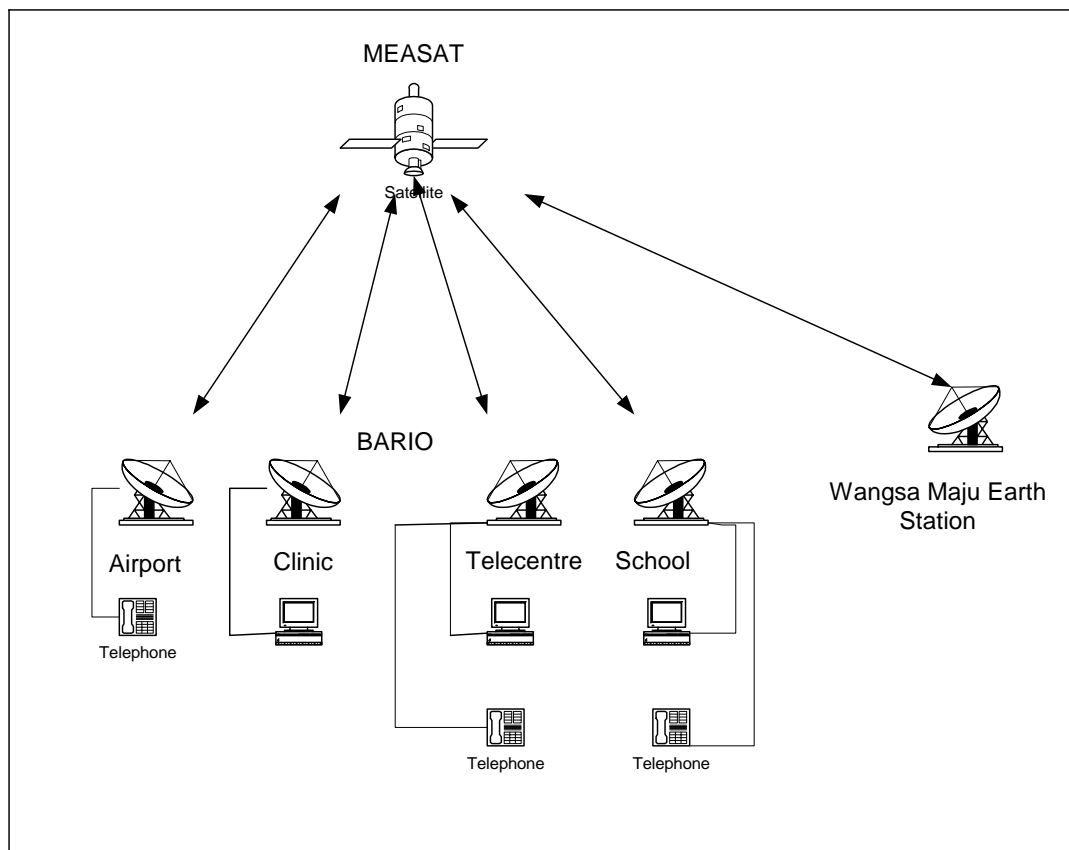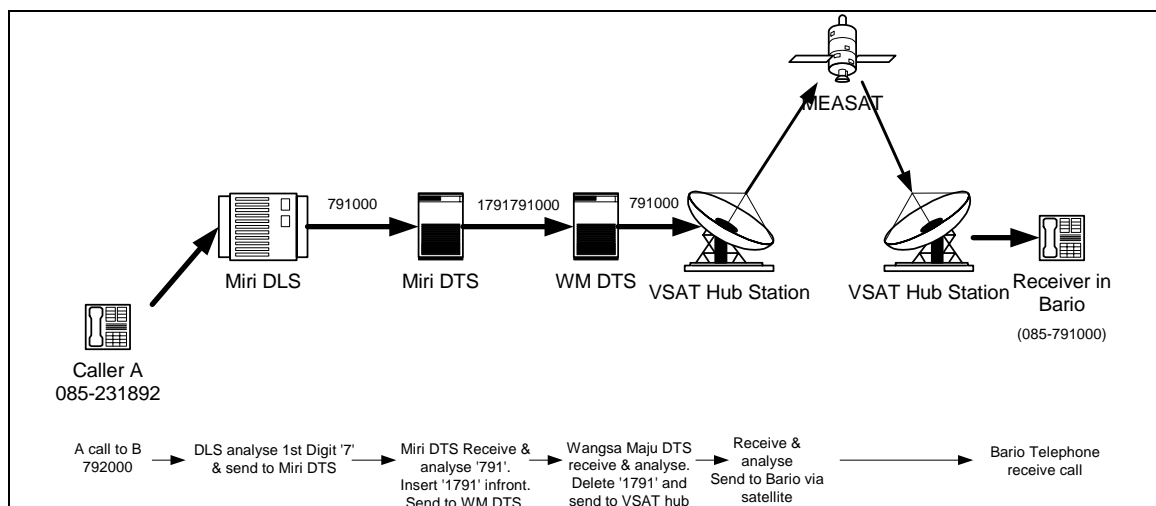
Figure 1. Satellite connection in Bario

Figure 2. Routing of call made to Bario

5. Call Routing

As Bario and Long Bedian are in Miri division, it is logical to preserve the same call area code status as Miri which is 085. The call routing for both the same and adjacent area codes therefore has been set to go through Miri Exchange before being routed to Wangsa Maju VSAT Hub station for satellite connectivity via satellite equipment. Figure 2 shows the Digit Analysis/Routing procedure.

Callers from the same call area or adjacent call area will be routed to the Miri Digital Local Switch (DLS) first before being sent to Wangsa Maju Digital Telephone Switch (DTS) via Miri DTS. With this procedure the call charges will be made at Miri DLS.

When the Miri DLS received the called digit it will analyze the 1st digit, which is '7'. Digit '7' will be routed to Miri DTS where another 4 digit, '1791' is inserted infront and later routed to Wangsa Maju DTS. At Wangsa Maju DTS, the inserted digit, '1791' will be dropped and the original called digits will be sent to the VSAT hub station. From here, it will be sent via satellite to Bario.

6.   Wireless LAN Connection

SK Bario (primary school) is located about 300m from SMK Bario (secondary school) and is separated by a field. In order for SK Bario to be connected to Internet it has to be connected to SMK Bario, which has Internet access. As cables are not suitable because of the high cost involved in transporting and maintaining them, one alternative is to use wireless. Wireless is much easier to set-up and does not spoil the village's beautiful environment.

The equipment used in the installation of the wireless network comprises Cisco Aironet 350 series and 340 series Bridges. The bridge in SMK Bario is placed at the principal's room and the other bridge is placed in the computer laboratory of SK Bario. Figure 3 shows the layout of the two schools and Figure 4 shows the view of SMK Bario seen from SK Bario.

The two Cisco Aironet 340 Series Wireless Bridges, each equipped with a 2.2dBi removable dipole antenna, provides an outdoor point-to-point wireless connection or radio link between the wired LANs at SMK Bario and SK Bario.
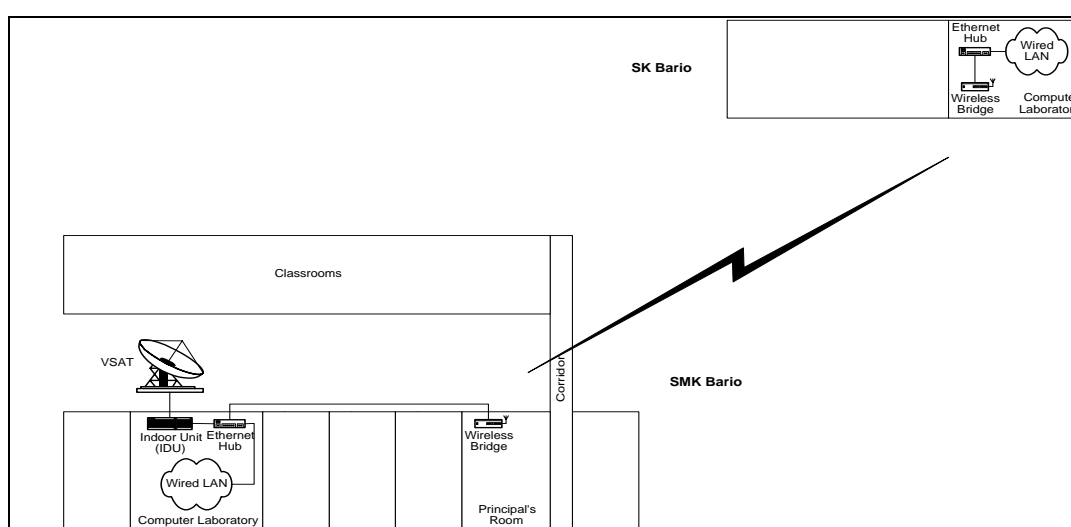

Figure 3. The layout of SMK Bario and SK Bario

Figure 4. A view of SMK Bario across a field from SK Bario

7. Conclusion

The e-Bario and the e-Bedian project have shown that connecting the most remote areas in Sarawak is very challenging but not impossible. In the absence of both regular power supply and telecommunication infrastructure, the e-Bario and e-Bedian was successfully implemented providing ICTs to the community. VSAT was used successfully to connect Bario and Long Bedian with the outside world. Alternative transmission medium such as microwave and cables are not suitable for places like Bario and Long Bedian because of high cost of implementation and maintenance.

Unlike the fast developing technology such as mobile communication or wireless, the development of rural ICT is slow, as it does not generate much revenue for telecommunication companies. Thus, there is a need for more research to be conducted on rural ICTs employing advanced technology which can be implemented at low cost.

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